METHOD FOR ZOOMING

Technical Field

The present invention relates to a method for zooming in a digital image that is being presented on a display device and a method and a device for generating
5   an image for electronic presentation.

Background of the Invention

Images contain and consist of a lot of data. It takes a long time to download large images through a
10   network and this causes undesired waiting times. Download of images is often performed when surfing the Internet or when in other ways connected to a network of computers. The waiting times will be considerably longer if using a slow transmission link, such as being connected to the
15   Internet through a modem. These waiting times are so long today that many users will not even bother to try to download a large image when using a slow transmission link.

In order to reduce the waiting times of downloading,
20   it is known to compress the images so that the amount of data that is downloaded is reduced. However, image compression could only be performed up to a certain limit, then image information is being lost. An image that has been compressed sufficiently to allow short
25   downloading times will then not show enough details.

Attempts have been made to solve this problem in several ways. One way is to present a small image, which has been hugely compressed. The user could then choose if he wants to download the original, large image by click-
30   ing on the image to get the download. This download takes time but is not forced on the user.

Another method is disclosed by Talagala et al., *Usage Patterns of a Web-Based Image Collection*, IEEE Symposium on Mass Storage Systems 1999: 203-214. Accor-

ding to this method an image is stored in different magnitudes on a server. When a user accesses a web site, the image is first presented in the smallest magnitude and a user could click to zoom in the image. The image is

5 then downloaded in a larger magnitude and presented to the user. If the image size exceeds an image frame in the web site, the area in which the user clicked is presented and the image could be panned to show other parts of it. The image is divided into smaller tiles, which are down-

10 loaded in sequence, and so the image is presented bit by bit during downloading.

According to these methods a large image is not presented until the user explicitly asks for it. However, when a user wants to see an image in larger detail, a

15 large image is downloaded causing waiting times. The small tiles, in the method according to Talagala et al., make the downloading time of an individual tile rela- tively short, but the header of the image file is rather large in order to control where each tile should be

20 presented in the image. The user sees the image being built up bit by bit by the tiles, but has to wait for a while before all tiles have been downloaded.

Summary of the Invention

25 The object of the invention is to solve the above- mentioned problem and provide an improved method for zooming in an image. A further object of the invention is that the zooming method should require only small memory capacities and involve no or short waiting times.

30 The objects of the invention are achieved by a method for zooming in a digital image that is being presented on a display device connected to a storage unit. Said presentation image is loaded to the display device from said storage unit and said presentation image

35 comprises at least one preselected, zoomable area. The method comprises the steps of continuously zooming in on the preselected area in the presentation image, and

during the step of continuous zooming, loading a detail
image information data set to the display device from the
storage unit. Said detail image information data set is
used for presenting the preselected area in higher reso-
lution than in the presentation image. The method further
comprises the step of improving the resolution of the
zoomed-in-on, preselected area in the presentation image
on the display device by means of the loaded detail image
information data set when the zooming in on the pre-
selected area in the presentation image is complete.

According to the invention, there is no need for
loading of extensive images. Only the information that is
asked for is loaded. When a zooming occurs, the loading
of a detail image information data set implies that only
information of the selected area is loaded. This sets a
low demand on the amount of data that has to be loaded
and the amount of memory occupied in the storage unit as
only the interesting parts of the image have to be stored
in a high resolution. This also gives a provider of the
image the possibility of only allowing zooming in on
those parts of the image that the provider wants to show.
The focus could thus, for example, be directed at a
certain article among other ones in the image that the
provider wants to sell.

Furthermore, the waiting times are avoided comp-
letely or almost completely, since the loading of the
detail image information data set occurs during the
continuous zooming in the presentation image. A user will
not notice the time passing during the loading of the
detail image because of the continuous zoom that is
taking place during that time. The continuous zooming is
performed in the presentation image and when the zooming
is completed the resolution of the zoomed-in-on, pre-
selected area is improved by means of the loaded detail
image information data set.

The storage unit could be accessed directly by the
display device or through any kind of network connection,

such as through a wireless network or through a physi-
cally connected network. Thus, the storage unit could be
a persistent memory on a device or a server on a network.
The zooming could then be used both for images downloaded
5 from a network to the display device or for images that
are stored in a restricted, very small memory space, such
as in a Personal Digital Assistant, PDA. The detail image
information data set comprises information about a detail
image in higher resolution of the preselected, zoomable
10 area. The information data set could be stored as a file
or a scattered data set on the storage unit.

When the preselected area is zoomed in on, it could
be the only part of the presentation image that is pre-
sented. Alternatively, parts of the presentation image
15 outside the preselected, zoomed-in-on area could be
presented with it.

In a preferred embodiment, the detail image infor-
mation data set comprises a difference image, said
difference image representing the difference between the
20 zoomed-in-on, preselected area in the presentation image
and a detail image representing the zoomed-in-on, pre-
selected area in higher resolution.

The difference image is defined as a matrix, in
which each element represents the difference in that
25 position between the pixel values of the zoomed-in-on,
preselected area and the detail image. This difference
image has many values that are zero or close to zero and
could thus be heavily compressed, since the detail image
and the zoomed-in-on, preselected area are very similar.
30 The difference image could then be very small and loaded
in a very short time.

Preferably, the step of improving the resolution
comprises the steps of adding the difference image to the
zoomed-in-on, preselected area in the presentation image
35 to generate a detail image of the zoomed-in-on, pre-
selected area in higher resolution and replacing the
zoomed-in-on, preselected area in the presentation image

on the display device by the detail image. As a result, the image quality of the zoomed-in-on, preselected area is easily improved by a simple pixelwise addition of the difference image to the zoomed-in-on, preselected area.

5   In another embodiment, the detail image information data set comprises a detail image representing the pre-selected area in higher resolution than the presentation image. Thus, the detail image information data set holds a complete detail image in higher resolution of the

10   zoomed-in-on, preselected area, which detail image is prepared for presentation.

       Preferably, the step of improving the resolution comprises the step of replacing the zoomed-in-on, pre-selected area in the presentation image on the display

15   device with the detail image when the zooming in on the preselected area in the presentation image is complete.

       The step of improving the resolution is then per-formed by simply presenting the loaded detail image over the zoomed-in-on, preselected area.

20   Preferably, the method further comprises the step of zooming out from a detail image that is being presented on the display device. The step of zooming out comprises the steps of replacing the detail image on the display device by the corresponding completely zoomed-in-on,

25   preselected area in the presentation image, and sub-sequently continuously zooming out from the corresponding area of the presentation image until the entire presen-tation image is presented. As a result, the method provides a further possibility of zooming back out to the

30   presentation image. This zooming out is also performed without annoying waiting times as the corresponding area of the presentation image has previously been zoomed in on and thus could be stored in a cache memory of the display device. The detail image could then instantly be

35   replaced and the zooming out is performed continuously so the time for zooming out is not noticed.

In a preferred embodiment, the presentation image is being presented in a window on the display device and the continuous zooming is performed in the same window so that a gradually smaller/greater part of the presentation

5   image is shown in the window during the continuous zooming. The window does not have to be changed in size, which means that other objects that are simultaneously presented on the display device are not affected. Furthermore, the focus of the observer is held on the

10   detail that is being zoomed in on.

In another preferred embodiment, the continuous zooming expands/reduces the preselected area over the presentation image so that the preselected area gradually covers a greater/smaller part of the presentation image.

15   The presentation image is then kept as a background to the zooming operation and the preselected area in the presentation image is expanding to cover a gradually greater part of the presentation image. In this way, there are no problems of matching the proportions of the

20   preselected area to the proportions of the presentation image, as the preselected area could be filling just a part of the presentation image when zoomed in on. Thus, there is no restriction on the form of the part that is filled.

25   Preferably, the detail image fills the window when replacing the zoomed-in-on, preselected area in the presentation image. This provides that the detail image is presented on the largest possible scale without affecting other objects that are presented on the display

30   device.

Advantageously, the boundaries of the preselected, zoomable areas in the presentation image are indicated in the presentation image to highlight the preselected, zoomable areas. As a result, the areas that can be zoomed

35   in on are marked so that a user can easily see which parts can be zoomed in on. This could also generate a

curiosity of the user and thus encourage him to click to get a detail image of the zoomable areas presented.

In a preferred embodiment, a detail image comprises preselected, zoomable areas and zooming in on one of these preselected areas is performed in the same manner as for the presentation image. As a result, several steps of zooming in can be performed in the image that is being presented.

In another preferred embodiment, meta data is associated with at least one of the presentation image and the detail images. This gives a lot of extra possibilities for the presentation of the image. The meta data could include statistics or other information about objects that are being presented. The meta data could then be presented when the image with which the meta data is associated is presented. The meta data could include text information, sounds, videos etc.

Preferably, the meta data comprises search criteria to enable a user to search for a specific detail image. As a result, objects presented in each image could be included in the meta data so that an image could be searched for depending on what is shown in it.

Desirably, a search results in a pointer to a requested detail image. A step of presenting the requested detail image comprises the steps of determining a current image, which is the image that is currently presented on the display device, and determining a common image for the current image and the requested image. The common image is the image of largest scale that includes both an area corresponding to the current image and an area corresponding to the requested image. The step of presenting the requested detail image further comprises the steps of zooming out from the current image to the common image, and zooming in from the common image to the requested image. As a result, a user can be guided to an image that is requested through a search. The user will

then get a clear understanding of where the presented detail image is located in a larger perspective.

Preferably, the meta data associated with an image is shown when the image is presented on the display device. Thus, a sound file could be played or a short text with information could be shown when an image is presented. The user will then get more information about the presented image and only the information that is relevant to the presented image is shown.

According to another embodiment, the meta data associated with a detail image is shown when a marker on the display device is in a corresponding area of the presentation image. Thus, the user gets information about what a detail image is depicting and could then choose if he wants to see this in larger magnification.

According to a preferred embodiment, the preselected areas are arbitrarily orientated in the presentation image. This implies that the detail image is not restricted to a certain orientation. An object in the image that is to be presented in higher resolution can then be fitted to fill the detail image as much as possible.

Preferably, the continuous zooming in the presentation image includes a simultaneous rotation of the presentation image to fit the orientation of the pre-selected area into the window. The zooming in on the detail image is then performed in the same window and the presented image will always be in this window. The rotation implies that a user will be guided to the view of the detail image from another angle. Also, the zooming is performed continuously and the change in viewing angle is achieved smoothly during the zooming.

The objects of the invention are also achieved by a method for generating an image for electronic presentation. The method comprises the steps of determining a main image that the presentation is to be based on and generating a presentation image from the main image by compressing and reducing the information in the main

image. The method further comprises the steps of selec-
ting areas in the main image that are to be presentable
in a higher resolution than corresponding areas in the
presentation image and generating detail image infor-
5   mation data sets for the selected areas from the main
image. The detail image information data sets are used
for presenting the preselected areas in higher resolution
than corresponding areas in the presentation image. The
method further comprises the step of associating the
10 detail image information data sets with the corresponding
areas in the presentation image to enable a load of one
detail image information data set simultaneously with a
continuous zooming in on the corresponding area of the
presentation image.
15   In this way, several small image information data
sets are generated, and each small image information data
set is loaded separately. This means that only a small
amount of data has to be loaded at a time, as the presen-
tation image and the detail image information data sets
20 are small. The loading time is then shortened and thanks
to the simultaneous zooming in the presentation image,
when a detail image is loaded, a user does not notice
this loading time, or notices only a very short delay.
The compressing and reducing of information in the main
25 image to generate the presentation image is performed to
get a presentation image requiring sufficiently small
memory. Information that is not needed could then be cut
off and not included in the presentation image. Thus, the
smallest details might not be discerned in the presen-
30 tation image. Furthermore, only information about the
selected area is needed in each detail image information
data set, which implies that these data sets can be very
small.
        Preferably, the step of generating a detail image
35 information data set comprises the step of generating a
detail image for the selected area from the main image,
wherein the detail image represents the selected area in

higher resolution than the corresponding area in the presentation image.

Thus, a detail image is generated before the presentation of the selected area in high resolution. This implies that the detail image could be processed in beforehand and thus be compressed and the image quality could be enhanced.

In a preferred embodiment, the step of generating a detail image information data set further comprises the step of zooming in on the corresponding area in the presentation image to the selected area. The step of generating a detail image information data set further comprises the steps of computing the difference between the zoomed-in-on, corresponding area in the presentation image and the detail image to generate a difference image and storing the difference image in the detail image information data set. As a result, the detail image information data set could be very small. The difference image could be heavily compressed, since it holds the differences between two very similar images and thus many values are zero or close to zero. This implies that small memory space is required and the detail image information data set could be loaded quickly.

In another embodiment, the step of generating a detail image information data set further comprises the step of storing the detail image in the detail image information data set. Thereby, the generating of the detail image information data set is fast and no processing is needed for presentation of the detail image when the detail image information data set has been loaded.

Preferably, the generated presentation image and the generated detail images are of the same size. As a result, the presentation image and the detail images could be displayed in a window of unchanged size. Thus, the presentation of the image will not affect other objects presented around the image.

In a preferred embodiment, the selected areas are arbitrarily orientated in the main image. As a result, this could be used to fit the object in the detail image so that it fills the detail image as much as possible,

5 and thus could be shown in highest magnification.

Preferably, the method further comprises the step of rotating the detail images so that they are oriented in the same way as the presentation image. This implies that an object that is inclined in the presentation image

10 could be presented in a raised orientation when the detail image is presented.

In a preferred embodiment, the method further comprises the step of selecting a subarea within a selected area in the main image. The subarea is to be

15 presentable in a higher resolution than the corresponding subarea in the selected area. The method further comprises the steps of extracting information from the subarea in the main image to generate a detail image of the subarea, and associating the detail image of the

20 subarea with the corresponding area in the detail image of the selected area. Thereby, zooming in several steps is enabled.

In another preferred embodiment, the method further comprises the steps of determining an additional main

25 image of a selected area in the original main image depicting the selected area in higher resolution than the main image, and compressing the additional main image to generate a detail image. When an object in the original main image is shown in low resolution, an additional main

30 image depicting this object in higher resolution could be used to allow a user to get a better view of the object. Then further zooming in on this object could also be achieved.

In yet another preferred embodiment, the step of

35 generating a detail image comprises the step of transforming a view in a first perspective of an object in the selected area into a view in a second perspective of the

object. This implies that the perspective of the detail
image could be transformed so that an object in the
detail image is presented as if it were placed in a plane
of the image. The transformation could take care of

5   distortions occurring when the object has parts that are
positioned at different distances from a camera capturing
the main image.

Preferably, a corresponding area showing an object
in a first perspective is replaceable, during presen-

10 tation, by a detail image generated from an additional
main image that shows the object in a second perspective.
Thereby, the object could really be depicted in the
second perspective. This additional main image could also
be used to create detail images of subareas in order to

15 enable zooming of parts of the object.

Brief Description of the Drawings
       The present invention will now be described in more
detail by way of example referring to the appended

20 drawings.
       Fig. 1 is a flowchart showing a method of prepa-
ration of an image for presentation.
       Fig. 2 is a flowchart showing a method of zooming in
an image.

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Detailed Description of a Preferred Embodiment of the
Invention
       Referring to Fig 1, a method for preparing an image
for electronic presentation will be described. This pre-

30 paration could be performed by, for example, a designer
of a web page that is to comprise images, or a designer
of software that will present images. According to the
invention, the designer uses software that automatically
generates associations between images and connections to

35 a web site, when the designer selects the images.
       First, a main image that the presentation is to be
based on is chosen, step 2. Preferably, the main image is

of high resolution and/or of a large size, thus contai-
ning a large amount of information. The main image is
then compressed and reduced in size to create a presen-
tation image, step 4. The presentation image is the image
5   that is to be presented electronically and is of a rela-
tively small size containing a small amount of data.
Thus, the presentation image requires small memory space
and can be loaded quickly.

     Next, the presentation image is processed, step 6,
10   in order to have as high quality as possible while
retaining its small amount of data. Thus, filters, such
as anti-aliasing filters, could be applied to the presen-
tation image, in order to correct for errors arising
during the creation of the presentation image by the
15   compressing of the main image. Thereafter, the presen-
tation image is saved on a storage unit, step 8, from
which a display device could load the presentation image
for presentation.

     Next, areas in the main image, which are to be
20   presentable in higher resolution than in the presentation
image, are selected, step 10. The selected areas are
compressed and reduced to create detail images, step 12.

     Preferably, the detail image is of the same size as
the presentation image. Thereby, the detail image takes
25   up an equally large area as the presentation image when
presented. Therefore, the selected area in the main image
preferably has the same proportions as the main image
itself, whereby the detail image could be of the same
size as the presentation image without requiring distor-
30   tion of the selected area. If a selected area in the main
image is smaller than the presentation image, the selec-
ted area has to be enlarged during the creation of the
detail image, but the data in the selected area can still
be compressed.

35   The small size and low resolution of the presen-
tation image implies that details in the presentation
image are not clearly presented. Therefore, the detail

images are created, so that interesting parts of the presentation image could be presented in a higher resolution. As for the presentation image, the detail images are processed, step 14, to obtain as high quality as

5 possible while retaining a small amount of data of the detail image. The image processing needed for the detail image could be more extensive if the selected area has been enlarged for creation of the detail image. The image processing could then e.g. have to include more

10 smoothening of the image.

The detail images could be used for direct presentation on a display device. Then each detail image is stored in a detail image information data set that is loaded when the detail image is to be presented.

15 In an alternative embodiment, the corresponding area in the presentation image to the selected area is zoomed in on to present the corresponding area in the same size as the detail image. Next, a difference between the detail image and the zoomed-in-on, corresponding area in

20 the presentation image is computed and stored in a difference image. The difference is computed by subtracting each pixel value in the detail image from the corresponding pixel values in the zoomed-in-on, corresponding area and storing the differences in corresponding elements of

25 a matrix of the difference image.

The difference image that has been generated is a matrix with values between -255 and 255, if each pixel value is stored in a byte. Very few absolute values in the difference image are larger than 127. Therefore,

30 these values are set to -128 if they are negative and +127 if they are positive. Alternatively, the first bit could be stripped off, which will automatically transfer all values between -255 and 255 to be between -127 and 127. Next, 128 is added to all values in the matrix, so

35 that it will contain values between 0 and 255 as in images. The difference image is then compressed with an image compression algorithm.

The difference image could be compressed even further by stripping off more bits or setting a lower threshold of the highest absolute value. Thus, all absolute values larger than, for example 63, could be set
5   to -64 if they are negative and to 63 if they are positive. Alternatively, the least significant bits could be stripped off. For example, the bits could be shifted three steps to the right so that the three least significant bits are ignored. These bits hold the least
10 information as they represent the lowest values and therefore there is no great loss of information when they are skipped.

The detail image is of higher resolution and sharper, and thus edges and contours will generate the
15 largest differences in the difference image. However, the detail image and the zoomed-in-on, corresponding area in the presentation image are very similar and most of the difference values will be zero. Therefore, the difference image could be heavily compressed and will require very
20 small memory space and loading time. The zoomed-in-on, corresponding area in the presentation image could be smoothed to reduce the differences between the images and enable the difference image to be even smaller. The difference image is stored in a detail image information
25 data set.

Next, the detail image information data sets are stored, step 16, in the storage unit. The detail image information data sets are associated with corresponding areas in the presentation image so that when such a
30 corresponding area in the presentation image receives a command during presentation, the detail image information data set responding to that area is loaded. Coordinates of the corners of the areas in the presentation image that correspond to the detail images are stored, step 18,
35 in a database. Each corner of the corresponding area is associated with a corner of the presentation image, thus defining the orientation that the corresponding area will

have when it is zoomed in on during presentation. Alter-
natively, the coordinates of one corner of the corres-
ponding area is stored in the database. In addition the
height, width and inclination angle of the area could be
5   stored.

Meta data that are associated with images are also
stored in the database. This meta data could then be
shown or activated when an image is presented or a
corresponding area in the presentation image is acti-
10   vated, e.g. by a marker being brought therein. The meta
data could also be associated with a certain area of any
form, a hot spot, in an image and thus be presented when
this area is activated. Thus, the meta data could be e.g.
some text describing or giving facts about the contents
15   of the image, or a sound file or a video file that is
played when presenting the image. Further, the meta data
could comprise search criteria, such as words describing
what an image depicts. This could be used during presen-
tation in such a way that if a user enters a search word,
20   the image associated with this word through the meta data
is selected for presentation.

Further areas in the main image could be selected
within the previously selected areas. Detail images of
these selected areas could then be created in the same
25   manner as described above, and these detail images are
then associated with corresponding areas in the pre-
viously created detail images. Thus, a tree for the
presentation of the images is created, where the presen-
tation image is the stem and the detail images are
30   branched in several steps off the stem.

Alternatively, an extra image captured in higher
resolution of a part of the main image could be used for
enabling further zooming in the presentation. The extra
image is then processed in the same way as the main image
35   to generate a detail image. This detail image is in the
same way as above associated with a corresponding area in
the presentation image. However, the quality of this

detail image could be higher compared to a detail image generated from the main image.

The presentation image and the detail images are now prepared for presentation. Referring to Fig. 2, a method according to the invention for zooming in an image will be described in detail. A presentation image stored in a storage unit is loaded to a display device, step 20. The loading time of the presentation image will be short due to the small size of the presentation image. When the presentation image has been loaded, the display device presents the presentation image, step 22, in a presentation window. The presentation image is stored in a cache memory connected to the display device so that it could be retrieved in a very fast manner during the presentation. The presentation image comprises zoomable areas that have been selected and prepared for zooming in accordance with the method described with reference to Fig. 1. The corner coordinates of the zoomable areas, which are stored in a database on the storage unit, could be used to draw frames indicating the corresponding areas in the presentation image, when it is presented.

A zoom in a presentation image could be initiated by a click in a zoomable area in the presentation image. However, the zoom could also be initiated by moving a cursor on the display device into the zoomable area. The zoom could also be initiated by activating a displayed key word or information text that corresponds to a zoomable area.

When a zoomable area is selected to be zoomed in on, step 24, the following routine is initiated. A continuous zoom is performed in the presentation image into the selected area, step 26, and simultaneously a detail image information data set corresponding to the selected area is loaded from the storage unit, step 28. Thus, a zooming is performed during the loading of the detail image information data set and a user does not experience any waiting time when the detail image information data set

is loading, as the zooming in the presentation image is performed at that time. When the zooming in on the selected area and the loading of the detail image information data set are complete, the resolution of the

5   zoomed-in-on, selected area is improved by means of the loaded detail image information data set, step 30. The zoomed-in-on, selected area of the presentation image is also stored in the cache memory.

Alternatively, the detail image information data set

10   comprises a difference image. The detail image information data set is then loaded very quickly. When, the difference image has been loaded, 128 is subtracted from all pixel values in the difference image to account for the adding of 128 that was done when the difference image

15   was created. If other operations have been performed on the difference image reverse operations are performed to account for these operations. For example, if the three least significant bits have been stripped off, the bits are shifted three steps to the left to account for this.

20   Thereafter, the average value of the ignored information in the least significant bits is added to all values. Thus, when the three least significant bits have been stripped off, 4 is added to all values.

When the selected area of the presentation image is

25   completely zoomed in on the difference image, on which the reverse operations have been performed, is added to the zoomed-in-on, selected area. The addition is performed pixelwise and the sum is the detail image in higher resolution than the zoomed-in-on area. This

30   requires that the zoomed-in-on, selected area is equal to the zoomed-in-on area that was used to generate the difference image. Thus, if that area was smoothed, the zoomed-in-on, selected area will have to be smoothed in the same way. The detail image can then be presented,

35   thus replacing the zoomed-in-on, selected area and improving its resolution.

The continuous zoom is performed as follows. First, coordinates of corners of the presentation image are determined. Then, coordinates of corners of the area selected to be zoomed in on are determined. During the zoom, the presentation image is replaced by temporary images that are continuously updated and show a gradually smaller part of the presentation image. The corners of the temporary images in the presentation image are linearly moved from the corners of the presentation image to the corners of the selected area.

A calculation speed is measured during the zooming by measuring the time for computation of the last temporary image. The number of steps in the zooming is then adapted to the speed for rendering temporary images. Thereby, the zooming is always equally fast regardless of the calculation speed. The size of each linear step is decided in accordance with the calculation speed. The step size could then be decreased at the end of the zooming, when the calculation speed has been determined. However, any distribution of the step size is possible.

In an alternative embodiment, the coordinates of one corner of the area selected to be zoomed in on is determined. This corner is associated with one corner in the presentation image. During the zooming, the corner of the presentation image is linearly moved towards the corner of the selected area. If the image needs to be rotated during the zooming, the rotation angle is determined. The step size of the rotation angle between two temporary images is determined by a cubic polynomial, which implies that the step size is of different sizes in the beginning and at the end of the zoom. This implies that the rotation angle could be small at the beginning of the zooming and be larger at the end of the zooming. Hereby, a risk that a temporary image would end up partly outside the presentation image is avoided.

When the corners of a temporary image have been decided the pixels of the area defined by the temporary

image are expanded to fill the presentation area. Each
pixel is compared to its eight adjacent pixels for
smoothing the temporary image as it is expanded. In this
way, the image is zoomed in on the selected area, which
5   at the end of the zooming fills the whole presentation
window. The replacement of a temporary image with a
subsequent temporary image is performed so quickly and
the steps between two subsequent temporary images are so
small that the zooming is experienced to an observer as
10 being continuous. Simultaneously with the zooming, the
detail image information data set corresponding to the
selected area is loaded from the storage unit. Thus, when
the zooming in the presentation image is complete, the
zoomed-in-on, selected area is replaced by the detail
15 image, which shows the area in higher resolution and
therefore of higher quality.

The zoomed-in-on corresponding area of the pre-
sentation image is stored in a cache memory connected to
the display device. This implies that a quick zooming out
20 is enabled, where the cached corresponding area replaces
the detail image and then zooming out is performed to the
presentation image in the same way as for the zooming in.

The zoomable areas in the presentation image could
be arbitrarily orientated. The linear movement of the
25 corners from the presentation image to the detail image
will automatically take care of a needed rotation of the
image to show the selected area in the same orientation
as the presentation image. A corner of the selected area
could be associated with an arbitrary corner of the
30 presentation image, which would enforce a rotation of the
selected area. If the presentation window is rectangular,
a selected area could be orientated in two different
fashions when filling the presentation window, and if the
presentation window is quadratic the selected area could
35 be orientated in four different fashions. The rotation of
the image is continuous during the zooming, so the

observer is smoothly guided to the new orientation in the
image.

Since the selected area is zoomed in on and sub-
sequently fills the presentation window, it is preferred
5   that the selected area and the presentation image have
the same proportions. The proportions could be different,
but then the selected area could not fill the presen-
tation window without distorting the image.

The zoomable areas are preferably indicated by
10   frames surrounding the areas. This shows which areas in
the image can be zoomed in on. The frame will also make
an observer curious and this will trig the observer to
zoom in on the area. Thus, the designer could make the
parts of the image that he wants to show zoomable and the
15   observer will by his own free will zoom in on these
parts. In such a way, the designer could tempt the
observer to zoom in on a detail image showing an object
he wants to sell.

In an alternative embodiment, the selected area
20   could be of a form that accounts for objects being
depicted in perspective. If the main image were rec-
tangular, the selected area would in this way be a
parallelogram. The image in the parallelogram could then
be transformed into a rectangle of the same size as the
25   presentation image. This transformation alters the
perspective of the image and a detail image created in
this way could thus show a plan view of the object.

Alternatively, the selected area could be divided in
two or more sections, wherein the perspective of each
30   section could be transformed independently and diffe-
rently.

In an alternative embodiment, where detail images
are branched in several steps off the stem, an observer
could be guided between images. If a specific image is
35   requested by the observer by e.g. a search for a word
specified in the meta data, the observer could automa-
tically be guided from the current image, that is the

image currently presented to him, to the requested image.
The current image, which is presented, is zoomed out from
until a common image is displayed. The common image is an
image that has both an area corresponding to the reques-
5   ted image and an area corresponding to the current image.
Then, the common image is zoomed in on until the reques-
ted image is displayed. Thus, the observer has been
guided from the image that was presented on the display
device to the image that he requested. The guiding could
10   include both zooming out from the current image and
zooming in from the common image. However, if the common
image equals the requested image, no zooming in is
required and if the common image equals the current
image, no zooming out is required.

15   The method for presentation of images described
above could be very useful for merchandising a fabric.
The fabric is not brought onto an observer against his
will, but instead the observer is tempted to zoom in on
an area in an image showing the fabric. This temptation
20   is caused by a frame indicating that the area could be
zoomed in on, which makes the observer curious and makes
him zoom in on the area.

      Another application for presentation of images
according to the invention is e-learning. If a student is
25   to learn about the human body, it could be presented to
him in an image. When the student wants to learn more
about e.g. the spleen, the image is zoomed in on to show
a detail image presenting the spleen and at the same time
meta data holding information about the spleen could be
30   presented. The student will then get an idea of where in
the body the spleen is situated, as the zooming in guides
him to the area, and he will also get the relevant infor-
mation presented.

      It should be emphasized that the preferred embodi-
35   ment described herein is in no way limiting and that many
alternative embodiments are possible within the scope of
protection defined by the appended claims. For example,

the detail images and the presentation image do not have
to be of the same sizes. The presentation window could
then be partially filled when a detail image of smaller
size than the presentation image is presented. Hereby,
5   the form of the detail image could also be chosen
arbitrarily. Alternatively, the size of the presentation
window could increase when a detail image of a larger
size than the presentation image is presented.

      The continuous zooming could also be performed in
10   alternative ways. For example, the presentation image
could be kept intact and form a background to the
zooming. The corners of the area that the zoomed-in-on
area is to fill and of the area in the presentation image
that is selected to be zoomed in on are determined.
15   Temporary images are then generated that show the selec-
ted area on an increasing scale. The corners of the
temporary images gradually move towards the corners of
the area that is to be filled. The temporary images are
generated by pixel expansion of the selected area in the
20   presentation image. During the zooming temporary images
are continuously replaced and the selected area is thus
gradually expanded to cover an increasing area of the
presentation image. When the zooming is completed, the
detail image representing the selected area in higher
25   resolution is presented.

      The area that the selected area is to fill could be
of the same size as the presentation image but it could
also be smaller. In the latter case, the presentation
image is shown in the background when the zooming is
30   complete. Furthermore, the area that is selected to be
zoomed in on could have an arbitrary form and still the
image contents will not be distorted if the area that the
zoomed-in-on area is to fill has the same proportions.
Alternatively, the zoomable area could have a simple
35   form, such as a rectangle, but the parts of the area that
are outside an object of a complex form could be trans-
parent when the zooming in is performed. Thus, the

presentation image in the background is seen behind the transparent part of the zoomed-in-on area.

According to a further alternative, the selected, zoomable area in the presentation image could be entirely or partly beside the area that the zoomed-in-on area fills. The selected, zoomable area is then visible in the presentation image in the background. During the zooming, the temporary images would then be continuously translated towards the area that the zoomed-in-on area is to fill.

In an alternative embodiment, the presentation image could be replaced dynamically by other presentation images showing related information. Thus, if a human body is shown, the presentation image could be replaced by an image where the skin has been peeled off, thus showing the muscles of the body. Alternatively, the side view of an object could be replaced by a front view of the object. The presentation image could be faded into showing the other presentation image. Alternatively, the transition could be performed by scrolling or squeezing.

In a further alternative embodiment, the presentation image could be larger than the presentation window. The observer would then be able to pan in the presentation image and select a zooming in on zoomable areas when shown in the presentation window. The detail image would then fill a part of or the entire presentation window. The presentation image could in this embodiment show a 360° rotation of a camera, that is when a user pans in the image a rotation of the camera that captured the image is simulated. The left and right sides of the presentation image could then be connected to each other so that the presentation image forms a cylinder watched from the inside. In the same manner, all sides of the presentation image could be connected to form a sphere watched from the inside.